

Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu & Accredited by NAAC with A++ Grade (3rd Cycle - 3.64 CGPA)
Dr. N.G.P. -Kalapatti Road, Coimbatore – 641048, Tamil Nadu, India
Web: www.drngpasc.ac.in | Email: info@drngpasc.ac.in | Phone: +91-422-2369100

Regulations 2024-25 for Post graduate Programme

(Outcome Based Education model with Choice Based Credit System)

M.Sc Microbiology Degree

(For the students admitted during the academic year 2024-25 and onwards)

Programme : Microbiology

ELIGIBILITY:

A pass in any one of the following Degree Course of B.Sc. Microbiology / Biotechnology / Biology / Botany / Zoology / Plant Science/ Animal Sciences / Biochemistry / Bioinformatics / Environmental Science / Food and Nutrition/ Clinical Lab Technology of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, Course to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc., Microbiology Examination** of this College after a course study of two academic years.

PROGRAMME OBJECTIVES:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation to:

1. Present intense knowledge in areas of organization and functioning of microorganisms.
2. Familiarize with the operations of bio instruments and related techniques.
3. Enable students to understand the applications of microbiology in healthcare, agriculture, food technology and environmental protection.
4. Provide opportunities to develop skills and participate in Research Projects.



Programme Outcomes

On the successful completion of the programme, the following are the expected outcomes.

PO Number	PO Statement
PO1	To impart knowledge of various branches of Microbiology and to understand the role of microorganisms in human welfare and sustainable development.
PO2	To acquire skills in the techniques used to observe and study the nature of microorganisms and the techniques, skills, and modern tools necessary for biological practice.
PO3	To appreciate the complexities of microbiological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.
PO4	To inculcate broad education necessary to understand the impact of microbiological solutions in a global and societal context; an ability to function in multi-disciplinary teams; To develop the ability to identify, formulate, and solve biological problems and to design and conduct experiments, as well as to analyze and interpret data.
PO5	To create awareness of contemporary issue and to appreciate the applications of Microbiology to become an entrepreneur.



CURRICULUM

M.SC. MICROBIOLOGY

A.Y – 2024-25

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits	
						Week	Total		CIA	ESE	Total		
First Semester													
24MBP1CA	Core - I	Fundamentals of Microbiology	4	-	-	4	48	3	25	75	100	4	
24MBP1CB	Core - II	Microbial Physiology and Bacterial Diversity	4	-	-	4	48	3	25	75	100	4	
24MBP1CC	Core - III	Mycology, Phycology and Lichenology	4	-	-	4	48	3	25	75	100	4	
24MBP1CD	Core - IV	Comprehensive Biology	3	1	-	4	48	3	25	75	100	3	
24MBP1CE	Core - V	Bio Analytical Techniques	3	1	-	4	48	3	25	75	100	3	
24MBP1CP	Core Practical - I	Basic Techniques in Microbiology	-	-	6	6	72	9	40	60	100	3	
24MBP1DA	DSE - I	Microbial Technology	3	1	-	4	48	3	25	75	100	3	
24BCP1DA		Cancer Biology, Diagnosis and Therapy											
24BTP1DA		Applied Biotechnology											
Total			21	3	6	30	360				700	24	




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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Second Semester												
24MBP2CA	Core - VI	Microbial Genetics	4	-	-	4	48	3	25	75	100	4
24MBP2CB	Core - VII	Immunology and Immunotechniques	4	-	-	4	48	3	25	75	100	4
24MBP2CC	Core - VIII	Virology	4	-	-	4	48	3	25	75	100	4
24MBP2CD	Core - IX	Medical Bacteriology	3	1	-	4	48	3	25	75	100	3
24MBP2CE	Core - X	Recombinant DNA Technology	3	1	-	4	48	3	25	75	100	3
24MBP2CP	Core Practical -II	Immunology and Molecular Techniques	-	-	6	6	72	9	40	60	100	3
24MBP2DA	DSE - II	Bionanotechnology	3	1	-	4	48	3	25	75	100	3
24BCP2DA		Biochemistry of Toxicology										
24BTP2DA		Forensic Biotechnology										
Total			21	3	6	30	360	-	-		700	24


BoS Chairman/HOD
 Department of Microbiology
 Dr. N. G. P. Arts and Science College
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BoS- 18th 08/11/2024	AC- 18th 26/11/2024	GB -



Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
24MBP3CA	Core - XI	Environmental and Agricultural Microbiology	4	-	-	4	48	3	25	75	100	4
24MBP3CB	Core - XII	Medical Mycology and Parasitology	4	-	-	4	48	3	25	75	100	4
24MBP3CC	Core - XIII	Pharmaceutical Microbiology and Quality Assurance	4	-	-	4	48	3	25	75	100	4
24MBP3CD	Core - XIV	Food Microbiology and Food Quality Control	4	-	-	4	48	3	25	75	100	4
24MBP3CE	Core - XV	Research Methodology and Biostatistics	3	1	-	4	48	3	25	75	100	3
24MBP3CP	Core Practical - III	Applied Microbiological Techniques	-	-	6	6	72	9	40	60	100	3
24MBP3CT	IT	Internship	-	-	-			-	40	60	100	2
24MBP3DA	DSE - III	Medical Laboratory Techniques	3	1	-	4	48	3	25	75	100	3
24BCP3DA		Free Radicals and Antioxidant System										
24BTP3DA		Molecular Therapeutics										
Total			22	2	6	30	360	-	-	-	800	27



Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Fourth Semester												
24MBP4CA	Core - XVI	Fermentation Technology	4	1	-	5	60	3	25	75	100	3
24MBP4CB	Core - XVII	Bioethics, Biosafety and IPR	4	1	-	5	60	3	25	75	100	3
24MBP4CV	Core - XVIII	Project and Viva - voce	-	-	16	16	192	-	80	120	200	8
24MBP4DA	DSE - IV	Molecular Diagnostics and Bioinformatics	3	1	-	4	48	3	25	75	100	3
24BCP4DA		Neurobiology										
24BTP4DA		Stem Cell Technology										
Total			11	3	16	30	360				500	17
*Grand Total											2700	92



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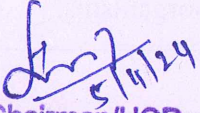
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M.Sc. Microbiology (Students admitted during the AY 2024-25)

EXTRA CREDITS COURSES

Self study paper offered by the Department of Microbiology

S. No.	Semester	Course Code	Course Title
1.	III	24MBPSSA	Good Manufacturing Practices
2.		24MBPSSB	Introduction to Human Anatomy


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05.04.24	17.04.24	



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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Semester – I

CORE: FUNDAMENTALS OF MICROBIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CA	FUNDAMENTALS OF MICROBIOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• History of Microorganisms• Basic techniques in Microbiology• Characteristics of algae, fungi, protozoa and viruses.	
Prerequisite	Knowledge on general characteristics and classification of microorganisms.	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explain the theories to understand the importance of microorganisms.	K2
CO2	Apply the principles of sterilization and disinfection. Make use of the types of Media.	K3
CO3	Compare and contrast the principles of Microscopy	K2
CO4	Compare and understand the characteristics of algae, fungi and protozoa.	K3
CO5	Compare and understand the characteristics of viruses.	K3

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓				
CO2	✓	✓	✓	✓	✓
CO3		✓		✓	✓
CO4	✓	✓			
CO5	✓	✓			



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M.Sc. Microbiology (Students admitted during the AY 2024-25)

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	History of Microbiology: The Historic foundations and development of Microbiology - Spontaneous generation- Germ theory of diseases – Cell theory – Contributions of Antony van Leuwenhoek – Joseph Lister – Robert Koch – Louis Pasteur – Edward Jenner – John Tyndall – Sergei N. Winogradsky – Salmon A. Waksman – Alexander Flemming - Paul Erlich – Fannie Hessie – Elie Metchnikoff, Lederberg and Zinder, Lwoff, Arber and Smith, Temin and Baltimore - Scope of microbiology.	10	Text book 1
II	Sterilization and culturing methods: Sterilization and disinfection - Physical and chemical methods. Culturing of Bacteria – Isolation, purification and Cultivation of different types of Microorganisms -Aerobes and Anaerobes - Culture maintenance and Preservation - Culture Collection centres -ATCC, MTCC and NFMCC.	10	Text book 2
III	Microscopy and Staining: Principles of Microscopy- Light microscope, Inverted microscope, Electron microscope – TEM and SEM, Polarization microscope, Confocal, Perifocal, Atomic force microscope. Stains and staining principles: Simple, Gram, Negative, Capsule, Spore, Flagellar and Acid fast staining.	10	Text book 1
IV	Prokaryotes: Characteristics of Prokaryotic cells – Basic cell types: Prokaryotic cells – Size, shape and Arrangement – Overview of structure – Cell membrane. Internal membrane structure – Cytoplasm- Nucleoid – Inclusions - chlorosomes – carboxysomes - magnetosomes - phycobilisomes -Endospores. External structure – Cell Wall - Flagella and its function – Glycocalyx – Slime layer.	9	Text book 2
V	Protozoa, Viruses, Fungi and Algae: General Characteristics of Protozoa. Structure and Reproduction of Paramecium sp. General Properties of Viruses. Cultivation of Plant and Animal Viruses. Characterization and Enumeration of Viruses-Plant Viruses- CaMV and RNA containing Plant Viruses- TMV. General characteristics of algae- Structure and reproduction of Chlamydomonas sp. General characteristics of fungi Structure and reproduction of <i>Aspergillus niger</i> .	9	Text book 2
	Total	48	



Text Book	1.	Black J G, 2015, Microbiology, 9th Edition, John Wiley and Sons, New Jersey, United States
	2.	Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2020, Prescott's Microbiology, 11th Edition, McGraw Hill Company, New York, United States.
Reference Books	1.	Micheal T Madigan, 2018, Brock Biology of Microorganisms, 14th Edition, Pearson Education, New Delhi
	2.	Jeffrey C Pommerville, 2010, Alcamo's Fundamentals of Microbiology, 9th Edition, Jones and Bartlett Publishers, Massachusetts, United States
	3.	Salle A J, 2014, Fundamental Principles of Bacteriology, 7th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi
	4.	Michael Pelczar, 2021, Microbiology, 5th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi.

Journal and Magazines	https://agrimoon.com/wp-content/uploads/Fundamentals-of-Microbiology.pdf
E-Resource and Websites	https://www.basu.org.in/wp-content/uploads/2020/03/Fundamentals-of-Microbiology-1.pdf

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/ Employability
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Semester – I

CORE: MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CB	MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY	Core	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The physiological, biochemical and metabolic properties of Microorganisms.• The respiratory and nutritional pathways of microorganisms.• The significance of Bacterial diversity.	
Prerequisite	Basic characteristic features and diversification among microorganisms	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To discuss the nutritional classification of microorganisms based on carbon, energy and electron sources.	K3
CO2	To comprehend nomenclature, classification, kinetics and types of enzymes with an emphasis on nature of enzyme Inhibitions.	K4
CO3	To confer the significance of different pathways of carbohydrate metabolism.	K3
CO4	To acquire the knowledge on the concepts of biosynthesis of amino acids, nucleotides, fatty acids and cell wall of Gram positive and Gram negative bacteria.	K2
CO5	To outline the diversified classes among bacteria.	K5

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Nutrition and Growth: Nutritional types of microorganisms - Phototrophs, Autotrophs, Lithotrophs, Organotrophs. Nutritional requirements -Macro, Micro nutrients and trace elements. Membrane transport – passive, facilitated diffusion, active transport (Proton Motive force, PTS, role of permeases), group translocation and ion uptake. Factors affecting Microbial growth – Temperature, pH, Osmosis, Pressure, Oxygen and Radiation. Physiology of Growth – Growth curve. Growth measurements – batch, continuous and synchronous.	10	Text book 1 Reference Book Journals
II	Enzymes and co-enzymes: IUBMB classification and nomenclature of enzymes, active site, Lock and key Mechanism and induced fit hypothesis, Enzyme kinetics - negative and positive. Enzyme inhibition: Reversible – Competitive, Non-competitive, uncompetitive and irreversible inhibition - Feedback inhibition. Regulatory and Allosteric enzymes.	9	Text book 1 Reference Book
III	Energy Production pathways: EMP pathway - Substrate level Phosphorylation - HMP Pathway –Entner Doudroff pathway - Glyoxalate pathway - Krebs cycle. Energy production: Electron transport chain and Oxidative phosphorylation, Pasteur Effect, Bioluminescence. Fermentations of Carbohydrates: Acidic: Homolactic, Mixed acid, Butanediol and Propionic acid fermentation. Alcoholic fermentation: Ethanol. β – Oxidation of Fatty acids.	10	Text book 1 Reference Book Journals
IV	Biosynthesis of Biomolecules: Biosynthesis of Aspartate, pyruvate, histidine and serine amino acid families - Purine and pyrimidine nucleotides - Denovo and salvage pathway. Biosynthesis of fatty acids and lipids. Biosynthesis of gram positive and gram negative cell wall.	9	Text book 1 Reference Book
V	Bacterial Diversity: Introduction to Archaea – Ecology, Cell walls and membranes, Genetics and molecular biology, metabolism. Archaeal taxonomy – Outline characteristics – Crenarchaeota and Euryarchaeota. Methylotrophs – Methanogens. Eubacteria - Photosynthetic bacteria, Cyanobacteria – Spirochaetes - Bacteroidetes. Characteristics of Proteobacteria: Alpha (Rickettsia), Beta (Neisseria), Gamma (Pseudomonas), Delta (Desulfovibrio) and Epsilon (Helicobacter). Low G+C gram positive (Staphylococcus) and High G+C gram positive (Mycobacterium). Case study on Profiling of Microbial Community from different soil.	10	Text book 1 Reference Book Journals
	Total	48	



Text Book	1.	Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2016, Prescott's Microbiology, 10th Edition, Mc Graw Hill Company.
Reference Books	1.	David White and George D. Hageman, 2000, Microbial Physiology and Biochemistry Laboratory, Oxford University Press, India.
	2.	Moat. A.G, J.W.Foster, 2002. Microbial physiology. 4th edition. John Wiley & sons. Australia.
	3.	Demain A.J. and Solomon INA, 1999. 2nd edition. Manual of Industrial Microbiology and Biotechnology, ASM press.USA.
	4.	Geoffrey Michael Gadd, 2008, Bacterial Physiology and Metabolism, Cambridge University Press, UK.

Journal and Magazines	https://www.frontiersin.org/journals/microbiology/sections/microbial-physiology-and-metabolism https://journals.plos.org/plosone/
E-Resource and Websites	https://onlinecourses.swayam2.ac.in/cec21_bt17/preview

Learning Methods	Chalk and Talk/ PPT / Seminar/ Assignment
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Focus of the Course	Skill Development/Employability
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Semester – I

CORE: MYCOLOGY, PHYCOLOGY AND LICHENOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CC	MYCOLOGY, PHYCOLOGY AND LICHENOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• To acquire knowledge of the diversity of Fungi, Algae, and Lichens• To gain knowledge on the structural organization and reproduction• To obtain knowledge on the importance of Fungi, Algae, and Lichens	
Prerequisite	Knowledge on types and characteristics of microorganisms	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To introduce diversity, classification and characteristics and acquire knowledge on economic quality of fungi	K4
CO2	To understand the organization and reproduction process of fungi	K3
CO3	To introduce classification, characteristics, and economic quality of algae	K4
CO4	To understand the organization, reproduction, cultivation and various roles of algae in the environment	K4
CO5	To grasp the basic characteristics, classification and economic importance of lichens	K4

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Classification and Characteristics of Fungi: Classification of fungi (Alexopoulos and Mims, 1979). Recent trends in classification of fungi. General characters of major classes: Mastigomycotina, Schizomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi.	10	Text book 1
II	Organization and Reproductions of Fungi: Thallus organization - reproduction, life cycle types, parasexual cycles, reduction in sexuality in fungi - physiological races in fungi - spore dispersal mechanisms and fungal genetics, study of fossil fungi.	10	Text book 2 Reference Book
III	Classification And Characteristics of Algae: Classification of algae (Fritsch, 1945). Salient features of major classes: Chlorophyta, Cyanophyta, Charophyta, Xanthophyta, Phaeophyta and Rhodophyta. Ultrastructure of prokaryotic and eukaryotic algal cells and their components. Economic importance of algae.	8	Text book 1 Reference Book E-book chapters
IV	Ecology, Cultivation and Life Cycle Patterns of Algae: Ecology of algae - algae as pollution indicators, algal blooms, algicides - culture and cultivation of fresh water and marine algae - Knop's solution and Chu-10 medium (1972). Origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae. Study of fossil algae.	10	Text book 1 Reference Book E books
V	Classification and characteristics of Lichens: Classification of Lichens (Hale, 1969). Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens, and Deuterolichens. Lichens as indicators of pollution. Economic importance of Lichens. Case Study- Algal diversity and algal bloom in water bodies of your native city or state.	10	Text book 2 Reference Book Journals
	Total	48	



Text Book	1.	Michael Madigan, 2015, Brock Biology of Microorganisms, 14th Edition, Pearson Publishers, New Delhi
	2.	Vashishta BR, Sinha AK, Singh VP, 2010, Botany for Degree students Algae, 1st Edition, S Chand & Company Ltd. India
Reference Books	1.	Alexopoulos CJ, Mims CW, Blackwell M, 2002, Introductory Mycology, 4th Edition, Wiley India Pvt. Ltd, India
	2.	Moore D, Robson GD, Anthony P, Trinci J, 2011, 21st Century Guidebook to Fungi, Cambridge University Press, United Kingdom
	3.	Thomas H. Nash, 2008, Lichen Biology, 2nd Edition Cambridge University Press, India
	4.	Ernst Atheran Bessey, 2020, Morphology and taxonomy of fungi, 1st Edition, Alpha Edition Publishers, India

Journal and Magazines	archive.bio.ed.ac.uk/jdeacon/microbes/fungalwe.html
E-Resource and Websites	https://gclambathach.in/lms/Algae.pdf
	https://gclambathach.in/lms/Algae.pdf

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Social Awareness and Environment
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Semester – I

CORE: COMPREHENSIVE BIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1CD	COMPREHENSIVE BIOLOGY	CORE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The structure and function of biomolecules• The basic concepts of developmental biology and cell signalling• The evolution of living cells.	
Prerequisite	Knowledge on fundamentals of cell biology.	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the importance of biological molecules.	K3
CO2	Cognize the basic concepts of developmental biology.	K3
CO3	Critically understand the idea on how a cell responds to external stimulus.	K3
CO4	Understand the inheritance of chromosomes.	K3
CO5	Cognize the formation and evolution pattern exhibited till date by living organisms over different time frames.	K3

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Structure of atoms, molecules and chemical bonds: Composition, structure and function of bio-molecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc.). Principles of biophysical chemistry (pH, buffer, thermodynamics, colligative properties). Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).	10	Text book 1
II	Basic concepts of developmental biology: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; fertilization and early development.	10	Text book 2
III	Cell Signaling: Cell signaling - Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.	10	Text book 1
IV	Inheritance biology: Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.	9	Text book 2
V	Evolution: Emergence of evolutionary thoughts Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Paleontology and Evolutionary History: The evolutionary time scale; Eras, periods and epoch. Case Study 1: Is there a scenario, where, within the earth, there are locations mimicking the ancient timelines with regards to temperatures (when the globe was formed from the sun due to explosion). If so, are we still witnessing abiotic synthesis even today?	9	Text book 2
	Total	48	



Text Book	1.	Dr. A. P. Singh & Kumar Pushkar, 2021, Upkar CSIR-UGC NET/JRF/SET Life Sciences, 1st Edition, Upkar Prakashan publishers, India.
	2.	Quaisher J. Hossain, Prashant Kumar, Ashish Nagesh, 2018, UGC CSIR NET / SLET (JRF & LS) Life Sciences, 4th Edition, Arihang Publications
Reference Books	1.	Pranav Kumar & Usha Mina, 2020, Pathfinder Academy: CSIR-JRF-NET Life Sciences Book Combo Set with Ecology, 1st Edition, Pathfinder Publication.
	2.	De Robertis, E. D. P, 2017, Cell and Molecular Biology, 8th Edition, Lea & Febiger, New York.
	3.	Van De Graaff, R. Ward Rhee, Sidney L. Palmer, 2013, Schaum's Outline of Human Anatomy and Physiology, 4th Edition, Mcgraw-Hill Companies, New York.
	4.	Michael Pelczar, 2021, Microbiology, 5th Edition, Tata Mc Hill Publishing Company Ltd., New Delhi.

Journal and Magazines	https://www.thebiomics.com/notes/csir/unit-11
E-Resource and Websites	Previous Year NET Life Sciences Question Paper EasyBiologyClass

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/ Employability/ Innovations
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Semester – I

CORE: BIO ANALYTICAL TECHNIQUES

Semester	Course Code	Course Name	Category	L	T	P	Credits
1	24MBP1CE	BIO ANALYTICAL TECHNIQUES	Core	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• To comprehend the principle and instrumentation of diverse instruments for• Microbiology• To procure knowledge on the working methods of different instruments• To appreciate its application in diverse fields	
Prerequisite	Knowledge on bioinstrumentation	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	To understand the principles, instrumentation with an emphasis on applications of Analytical centrifuge.	K3
CO2	To become equipped with the operational principle and working methods of spectral instruments	K2
CO3	To procure knowledge on the principles and techniques of various types of electrophoresis	K3
CO4	To acquaint the concept of radioactivity and its types of decay	K3
CO5	Application of knowledge for the characterization of Biomolecules	K2

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Centrifugation and Chromatography: Centrifugation: Principles and types - Low speed, High speed and Ultra centrifuge. Applications of Analytical Ultra Centrifugation – Determination of Molecular weight and purity of macromolecules. Chromatography: Instrumentation, detection methods and Applications of TLC, Column, Gas, Ion Exchange, HPLC, Gel Filtration, GCMS and LCMS.	10	Text book Reference Book Journals
II	Colorimetry and Spectrometry: Colorimetry: Principles, Instrumentation, Application and Analysis – Qualitative and Quantitative. Spectrophotometry: Principles, Instrumentation and Applications of UV, Visible, IR, NMR, FTIR, Atomic absorption, Mass Spectroscopy and MALDI – TOF, Spectrofluorometry and Flame Photometry	9	Text book Reference Book
III	Electrophoresis: Principles and Instrumentation - Separation of Nucleic acids – Agarose Gel Electrophoresis, Electrophoresis of RNA, Capillary Electrophoresis and Microchip Electrophoresis. Separation of Proteins – SDS – PAGE, Native Gel, Gradient Gel, Iso Electric Focusing, 2D Page, Cellulose Acetate Electrophoresis, Western Blotting - Detection, Estimation and Recovery of Proteins in gel.	10	Text book Reference Book
IV	Radiometry: Introduction - Detection and Measurement of Radioactivity –Detection based on gas ionization - Autoradiography and its applications – Scintillation Counting - Safety Aspects – Biosensors and its applications (DNA and Immunosensors).	9	Text book Reference Book
V	Quantification Methods for Biomolecules: Quantitative determination of Macromolecules: Carbohydrates (DNSA and Anthrone method), Lipids (Gravimetric), Protein (Lowry and Bradford method). Determination of Molecular weight of protein (MS and SDS-PAGE) and DNA (Agarose gel). Estimation of Microbial pigments: Chlorophylls and Carotenoids. Case study - Collect the various plant leaves from our college campus and analyze their compounds using chromatography techniques.	10	Text book Reference Book Journals
	Total	48	



Text Book	1.	L Veerakumari, 2011, Bioinstrumentation, First Edition, MJB Publishers.
Reference Books	1.	Keith Wilson and John Walker, 2010, Principles and Techniques of Biochemistry and Molecular Biology, Seventh edition, Cambridge University Press
	2.	Plummer .T David, 2004, An Introduction to Practical Biochemistry, Third Edition, TMH Publishers
	3.	Rodney Boyer, 2000, Modern Experimental Biochemistry, Third Edition, Pearson education Publishers
	4.	Swahney S K and Singh R, 2014, Introductory Practical Biochemistry, Narosa Publishing House

Journal and Magazines	http://www.omicsonline.org/analytical-bioanalytical-techniques.php
E-Resource and Websites	https://www.aminotes.com/2017/09/bioanalytical-techniques-study-material.html

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Entrepreneurship
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24MBP1CP	CORE PRACTICAL: BASIC TECHNIQUES IN MICROBIOLOGY	SEMESTER I
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Bacterial Staining techniques - Gram, Acid-fast, Spore, Capsule and Negative Staining.
2	Morphological observation of Fungi -LPCB Mount.
3	Micrometry – Measurement of Microorganisms.
4	Motility determination- Hanging drop and soft agar inoculation.
5	Enumeration of Microorganisms from soil: Bacteria, Fungi and Actinomycetes.
6	Determination of Bacterial generation time - Direct microscopic method and turbidity method
7	Effect of various intrinsic factors on the growth of bacterium – pH, Temperature
8	IMViC test, Hydrogen sulphide test, Oxidase test, Calalase test, Urease test
9	Preferential utilization of sugar - Carbohydrate fermentation & TSI; Polymer degradation – Starch, Casein
10	Quantitative determination of Sugar by DNSA method and Protein by Lowry et al method
11	Separation techniques: Chromatography- TLC and Column.
12	Microscopic observation of Algae and Lichen thallus

Note: Out of 12-10 Mandatory



References

- 1 James Cappuccino, Natalie Sherman, 2013, **Microbiology: A Laboratory Manual**, 10th Edition, Pearson Publishers
- 2 Aneja. K.R, 2012. **Experiments in Microbiology, Plant Pathology and Biotechnology**, 2nd edition. New age publisher
- 3 Rajan S. Selvi Christy.R, *Experimental Procedures in Lifesciences*, CBS Publishers & Distributors Pvt Ltd
- 4 Kannan, N, 1997, **Laboratory Manual of General Microbiology**, 1st Edition, Panima Publishing house



Semester – I

DSE I: MICROBIAL TECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MBP1DA	MICROBIAL TECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">• The production of Sustainable products using Microorganisms.• The importance of Microorganisms in Pharmaceutical sector.• How to explore the ideas in commercial level	
Prerequisite	Knowledge on microbial products and their mass production	
Course Outcomes (Cos)		
CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Inculcate about microbial products and its scale up production through establishing a small scale industry	K2
CO2	Exemplify the ideas about the production and uses of Biofuel and Biofertilizer.	K3
CO3	Demonstrate the commercial production of Biopolymers using Microorganisms.	K4
CO4	Understand the way of cells and enzymes were immobilized for industrial uses.	K3
CO5	Explore the pharmaceutical products and possibilities of converting it to a commercial product.	K4

Mapping with Programme Outcomes					
Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓		✓	✓	✓
CO4	✓		✓		✓
CO5	✓	✓		✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Single Cell Protein and its Economic Aspects: Bacterial, Yeast, Fungal and Algal Proteins –Brewer's and Baker's yeast – Food and Fodder yeast – Mushroom (<i>Agaricus</i> , <i>Oyster</i>) and Products from Higher fungi (<i>Ganoderma lucidum</i>).	9	Text book Reference Book Journals
II	Production of Biofuel & Biofertilizer: Production, Methods and Uses of Bioethanol (<i>S. cerevisiae</i>) – Biodiesel (<i>Chlorella</i>) – Biohydrogen (<i>Chlamydomonas</i>) – Biogas (Methanobacteria). Biofertilizer - N ₂ fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.	9	Text book Reference Book
III	Biopolymer production: Production and Uses of Polyhydroxybutyrate (PHB) – Xanthan – Alginate – Cellulose –Cyanophycin – Levan - Melanin - Welan - Succinoglucan- Curdlan- Chitosan -Polyhydroxyalkanoates - Hyaluronic acid.	9	Text book Reference Book
IV	Immobilization of Cells & Enzymes: Cells – Surface attachment of cells – Entrapment - Hydrogel method, Preformed support materials – Containment behind a barrier: Microencapsulation, Immobilization using membranes – Self aggregation of cells –Methods for Enzyme immobilization – Carrier binding method, Intermolecular cross linking – Applications of Immobilized cells and Enzymes.	10	Text book Reference Book
V	Microbial products with pharmaceutical importance: Vaccines – Steps of Manufacturing – Growing the microbes and separation – Preparation of Live and killed vaccine – Preparation of Toxoid and uses – BCG Vaccine – Cholera vaccine – Rabies vaccine – Diphtheria toxoid. Pharmaceutical industry - certification & accreditation required. Bioentrepreneurship opportunities and Funding sources - Government funds, Venture capital, NGOs, Crowd funding and Incubation centers. Antimicrobial compounds from soil microbes -Case study	11	Text book Reference Book Journals
	Total	48	



Text Book	1.	Patel A H, 2012, Industrial Microbiology, 2 nd Edition, Trinity Press, New Delhi
Reference Books	1.	El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2012, Fermentation Microbiology and Biotechnology, 3 rd Edition, CRC Press, USA
	2.	Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2010, Molecular Biotechnology -Principles and Applications of Recombinant DNA, 4 th Edition, ASM Publishers, USA]
	3.	Nidhi Goel, 2013, Pharmaceutical Microbiology, 1 st Edition, Narosa Publishing House, New Delhi.
	4.	Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2012, Microbial Technology -Concepts and Applications, 1 st Edition, MJP Publishers, New Delhi

Journal and Magazines	https://link.springer.com/ https://aem.asm.org/
E-Resource and Websites	https://www.microbialbiotechnology.com/ https://www.asmscience.org/content

Learning Methods	Chalk and Talk/ Seminar/ Assignment
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Focus of the Course	Skill Development/Employability/Entrepreneurial Development/Innovations/Intellectual Property Rights
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SEMESTER I
DSE I: CANCER BIOLOGY, DIAGNOSIS AND THERAPY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24BCP1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • Molecular basis of cancer, mutations causing cancer, and repair mechanisms • The basic principles of cancer development and available therapeutic options • The different diagnostic and treatment methods for cancer.
Prerequisite	Basic knowledge about cell biology

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K5
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer.	K5
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K6

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction: Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Apoptosis. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.	09	Text Book
II	Cancer epidemiology and endocrinology. Cancer causing agents- radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis: induced and spontaneous mutations, crossing over and segregation. Cancer genetics. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co- carcinogens, promoters and initiators, testing for carcinogenicity, Ames test. Aberrant metabolism during cancer development.	09	Reference Book
III	Oncogenes - RNA and DNA tumor viruses, retroviruses and viral oncogenes and abrupt activation. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncoproteins, tumor suppressor genes involved in cancer. Radiation- effect of ionizing radiations on DNA, chromosomal aberrations. Cancer Markers: Genetic basis of cancer, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, cell adhesion, invasion and metastasis, VEGF signaling and angiogenesis; role of transcription factors. Growth factors- EGF, TNF- α and TGF- β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.	10	Reference Book
IV	Cell Cycle Regulation cancer: control of the cell cycle - cyclins and CDKs, and tumor suppressor genes p53, p21Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes.	10	NPTEL
V	Principles and methods of cancer diagnosis - biochemical, genetic, cytotoxic, cell growth and viability tests. Diagnosis of cancer by histopathology, MRI scans, PET scan, cytogenetics test, karyotype, FISH. Strategies of anticancer drug therapy- chemotherapy, gene therapy, immuno therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications.	10	You Tube Videos
	Total	48	



Text Book	1.	Mc Kinnell R.G et al, 2012, "The Biological Basis of Cancer", Second edition, Cambridge University Press, London.
Reference Books	1.	Weinberg R.A, 2014, "The Biology of Cancer", Second edition, Garland Science, New York & London.
	2.	Vincent T. De Vita M. D et al, 2020, "Principles and Practice of Oncology: Primer of Molecular Biology in Cancer", Third edition, Lippincott Williams and Wilkins, Philadelphia.
	3.	Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bed side", Second edition, Wiley Black well, London
	4.	Hesketh R, 2013, "Introduction to Cancer Biology", First edition, Cambridge University Press, London.
	5.	Pezzella F et al, 2019, "Oxford textbook of Cancer Biology", First edition, Oxford University Press, London

Journal and Magazines	https://journals.lww.com/amjclinicaloncology/pages/default.aspx
E-Resources and Website	https://www.cancer.gov/research/resources ; https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
DSE I: APPLIED BIOTECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24BTP1DA	APPLIED BIOTECHNOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The applications of biotechnology in plant , animal and Environmental field the basic concept of sequence and series • The applications of biotechnology in health care sector • The products obtained from fermentation and its applications
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Prerequisite	Knowledge on Applied Biotechnology
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Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental applications of Biotechnology	K2
CO2	Know the basics and fundamentals of biotechnology applications in environment	K2
CO3	Discuss about the disease and disease prevention	K3
CO4	Discuss the applications of Enzymes in various fields	K4
CO5	Discuss the production and application of products obtained from fermentation technology	K2

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	
CO2	✓		✓	✓	✓
CO3			✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Agricultural, Plant Biotechnology and Animal Biotechnology: Applications of transgenic crop technology: Herbicide resistance (Glyphosate Resistance plants), Pest resistance (Bt Cotton) and Virus Resistance. Enhancement of micro-nutrients (Vitamin A). Delayed Fruit Ripening. Molecular pharming in plants. Transgenic animals (Transgenic mice and Transgenic cattle). Production and recovery of products from animal tissue cultures (Blood clotting factors, Growth hormones, insulin)	10	Text Book - 1
II	Environmental Biotechnology: Bioremediation- (Bioaugmentation and Biostimulation). Biodegradation of Xenobiotic compounds. Bioleaching. Microbially Enhanced Oil Recovery. Biotechnological methods for hazardous waste management. Bioindicators –Biomarkers –Biosensors – Management of effluent toxicity, heavy metal pollution, thermal and radioactive pollution	08	Reference Book - 2
III	Health Care Biotechnology: Disease prevention – vaccines: conventional vaccines, purified antigen vaccines, recombinant vaccines, DNA vaccines, synthetic vaccines. Disease Diagnosis – Probes, monoclonal antibodies and detection of genetic diseases. Disease treatment – interferons, monoclonal antibodies. Gene therapy, enzyme therapy and replacement. Forensic medicine.	10	Reference Book -3
IV	Enzyme Biotechnology: Enzymes used for diagnostic purpose- (acid phosphatase, alanine aminotransferase and alkaline phosphatase). Cardiac Biomarkers. Enzymes used for screening liver and kidney diseases. Enzymes used in food industry, leather industry, wool industry, dairy industry and textile industry.	10	Reference Book – 2 and NPTEL
V	Fermentation Biotechnology: Production, harvest, recovery and uses – enzymes, antibiotics (Tetracycline), vitamins (B2), aminoacids (glutamic acid), organic solvents (ethanol); organic acids (lactic acid). Single cell protein (algae), beverages (Wine). Formulation of Biofertilizer (Rhizobium), Biopesticides.	10	You Tube Videos and Reference Book - 4
	Total	48	




Text Book	1.	Bernard R Glick and Jack J Pasternak, 2010, "Molecular Biotechnology: Principles and Applications of recombinant DNA", 4 th Edition, ASM Press
Reference Books	1.	Marwaha S S & Arora K, 2000, "Food processing: Biotechnological application", Asiatech Publishers INC, New Delhi.
	2.	Palmer T, Bonner PLR, 2014, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2 nd Edition, Woodhead Publishing Limited, Oxford..
	3.	Owen, Jenni Punt and Sharon A Stranford, 2013, "Kuby Immunology", 7 th Edition, W.H. Freeman and Company, New York.
	4.	Stanbury PF and Whitaker A, 2007, "Fermentation microbiology and Biotechnology", 2 nd Edition, Taylor and Francis.

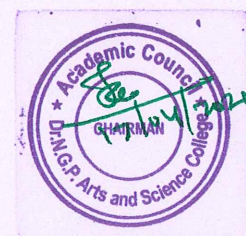
Journal and Magazines	https://www.macrothink.org/journal/index.php/jab , https://link.springer.com/journal/12010
E-Resources and Website	https://www.keaipublishing.com/en/journals/biotechnology-notes/ https://www.drishtias.com/to-the-points/paper3/biotechnology-and-its-applications https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Entrepreneurial Development /Employability
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Signature
5/4/24
BoS Chairman/HOD
Department of Microbiology
Dr. N. G. P Arts and Science College
Coimbatore - 641 048

 Dr.N.G.P Arts and Science College		
APPROVED		
BoS- 17 th 05.04.24	AC - 14 th 17.04.24	GB -



Dr.NGPASC

COIMBATORE | INDIA

M.Sc. Microbiology (Students admitted during the AY 2024-25)

Semester - II CORE: MICROBIAL GENETICS							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CA	MICROBIAL GENETICS	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the fundamentals behind classical genetics. mechanisms of gene replication and expression. the knowledge of Genetic material exchange and mutations.
Prerequisite	Knowledge on Basics of Microbial physiology

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the biological process by a historical approach to study classical systems of gene regulation in bacteria.	K2
CO2	Understand the topology of DNA and RNA, and evaluate the molecular mechanisms of DNA replication.	K2
CO3	Apply the principles of transcription and translation in gene expression.	K3
CO4	Compare the mutational types, DNA repair mechanisms, and apply the molecular markers to study the microbial diversity.	K4
CO5	Apply the horizontal gene transfer concepts in mapping of genes.	K3

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓		✓
CO3	✓	✓		✓	
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CA	MICROBIAL GENETICS
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Syllabus

Unit	Content	Hrs	Resources
I	Classical Genetics Mendel's Laws: Monohybrid - Dihybrid - Test cross, concept of dominance, segregation, independent assortment; Chromosome theory of inheritance. Chromosomes & crossing over. Sex-influenced and limited inheritance. Chromatin structure and organization.	10	Text Book 1 and 2
II	DNA and RNA DNA and RNA as genetic material. Nucleic Acid chemical composition, C value paradox, Physical structures of DNA, Circular and Superhelical DNA. RNA Structure and types. DNA Replication - Basic rule for replication of all nucleic acids - Geometry of DNA replication - Enzymology.	10	Text Book 1 and 2
III	Gene Expression Transcription: Transcription in prokaryotes and eukaryotes - structures of rRNA, tRNA and mRNA. Inhibitors of transcription. Reverse Transcription. Antisense RNA and its significant. Genetic code. Translation - Transfer of RNA and aminoacyl synthetases - codon, anticodon interactions - Wobble hypothesis. Post transcriptional and translational modification.	10	Text Book 1 and Reference Book 1
IV	Mutation and Molecular Markers Mutation - types of Mutation -Spontaneous and induced mutation. Mutagenesis- Physical and Chemical. DNA repair mechanisms: Photo reactivation - Excision repair - Recombination repair - SOS repair. Molecular Markers, RFLP, RAPD, AFLP and Isozyme Loci. CRISPR gene editing.	9	Reference Book 1
V	Gene transfer Mechanisms of Gene transfer in bacteria - Transformation - Transduction and Conjugation. Phage genetics, Phage T mutants, Genetic recombination, Genetic mapping of T4 Phage. Regulation of gene activity - Operon model- positive and negative operon: (Lac, Trp), Autoregulation - translational regulation. Case study: Consider that you have isolated a rod shaped bacterium from a sewage sample that has the potential of adapting to different environments. You have to analyze the up-regulation and down-regulation of different genes for different growth conditions through restrictive digestion.	9	Reference Book 1
Total		48	



Text book	1.	Freidfelder,D 1995, Microbial genetics. 1st Edition. New Delhi: Narosa Publishing House.
	2.	Gardner, E. J, Simmons, M J and D P Snustard, 2006, Principles of Genetics, 8th Edition, John Wiley and Sons, New York.
Reference Books	1.	Klug .W.S. and Cummings, M.R., 2016, Essentials of Genetics, 9th Edition, New Delhi: Pearson Publishers.
	2.	Larry Snyder, Joseph E. Peters, Tina M. Henkin, 2013, Molecular Genetics of Bacteria, 4th Edition, Wendy Champness, ASM Press.
	3.	David Freifelder, 2000, Microbial Genetics, 7th Edition Narosa Publishing House, New Delhi.
	4.	Jocelyn E. Krebs, Elliott S. Goldstein. Stephen T. Kilpatrick, 2014, Lewin's Genes - X, 11th Edition, Jones and Bartlett Learning.
	5.	Freifelder,D 2004, Molecular Biology. 1st Edition, New Delhi: Narosa Publishing House

Journal and Magazines	<u>Microbial genetics - Latest research and news</u> <u>Nature</u>
E-Resources and Website	<u>Microbial genetics</u> <u>Open Library</u>

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations / Intellectual Property Rights / Social Awareness/ Environment
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Semester - II							
CORE: IMMUNOLOGY AND IMMUNOTECHNIQUES							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CB	IMMUNOLOGY AND IMMUNOTECHNIQUES	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the structural features of the components of the immune system. the functions of Immune system. the mechanisms involved in Immune system development and responsiveness.
Prerequisite	Knowledge on microbes and allergens acting as antigens

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the knowledge of immune cells and organs in immune profiling.	K3
CO2	Understand the basis of immune response and properties of antigen and antibodies.	K2
CO3	Evaluate the Immuno-diagnostic methods for effective diagnosis.	K4
CO4	Assess the level of immune-regulation during microbial infection.	K4
CO5	Conclude the efficient HLA matching of donor and recipient in transplantation.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓		✓		✓



24MBP2CB	IMMUNOLOGY AND IMMUNOTECHNIQUES
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Syllabus

Unit	Content	Hrs	Resources
I	History and Scope of Immunology Historical background and scope of Immunology, Defence mechanisms of human body - First line defence - Anatomical and Physiological barriers - Second line defence - Fever, inflammation and Phagocytosis - Third line defence - Cells and organs of immune system.	10	Text Book 1 and 2
II	Immunity & Types Immunity - types of immunity - Natural, acquired, specific and non-specific, cell mediated and humoral, active and passive immunity. Antigens - properties, Epitopes, haptens, adjuvant, cross reactivity. Antibodies - properties, structure (primary & secondary) and isotypes. Diversity and specificity. Anti-antibodies. Complement pathway.	10	Text Book 1 and 2
III	Antigen-Antibody reactions Serology - Antigens and antibody reactions - Introduction and classification of antigens and antibody reactions - Agglutination and precipitation reaction. Strength of antigen and antibody binding - affinity & avidity. Therapeutic applications of monoclonal antibodies and Complement fixation reaction. Immunofluorescence, RIA, RAST, ELISA and Flow cytometry - RT-PCR.	10	Text Book 1 and Reference Book 1
IV	Lymphocyte Response Response of B-cell and T-cell to antigens. B-cell and T-cell products. Hyper sensitivity - Type I, II, III and IV - MHC antigens - types and functions. Immunity to infectious diseases - Viral, bacterial and protozoan.	9	Reference Book 1
V	Transplantation Immunology Transplantation immunology - Tissue transplantation and grafting - Mechanism of graft acceptance and rejection - HLA typing - Tumor immunology - Immunodeficiency disorders - Primary (SCID) and Secondary (AIDS) and auto immunity. Vaccines - Types and vaccination methods. Case Study on vaccines for Covid'19.	9	Reference Book 1
Total		48	



Text book	1.	Roitt IM, 2017, Essential Immunology, 13th Edition, Wiley-Blackwell Publishers, United States.
	2.	Kuby, 2018, Immunology, 8th edition, W.H.Freeman Publishers, New York.
Reference Books	1.	Tizard I R, 1995, Immunology an Introduction, 4th Edition, Saunders College Pub, United States.
	2.	Raif S. Geha and Luigi D. Notarangelo, 2016, Case Studies in Immunology: A Clinical Companion, 7th Edition, Garland Science Publishers, United States.
	3.	Lauren M. Sompayrac, 2019, How Immune System Works, 6th Edition, Wiley Blackwell, United States.

Journal and Magazines	<u>The Journal of Immunology American Association of Immunologists</u> <u>Immunology - Wiley Online Library</u>
E-Resources and Website	<u>Immunology Notes - Microbe Notes</u>

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester -II CORE: VIROLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CC	VIROLOGY	CORE	48	-	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> to get the basic knowledge on general properties of viruses to impart knowledge on bacterial, plant and animal viruses and their diagnosis. the role and production of conventional and modern viral vaccines and their mode of action
Prerequisite	Knowledge on general characteristics of viruses

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Classify viruses systematically.	K3
CO2	Analyse and interpret the properties of plant viruses bacteriophages.	K4
CO3	Evaluate and distinguish animal viruses	K4
CO4	Criticize the Routine and Molecular Diagnosis with special reference to Virology.	K4
CO5	Design attenuates and recombinant viral vaccines.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓
CO5	✓		✓	✓	✓



24MBP2CC	VIROLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction to Viruses General properties and Baltimore system of Virus classification. Cultivation and purification of viruses - Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virology laboratory. Basic immune response to viral infection. Virions and Prions.	9	Text Book2 E books
II	Bacteriophages and Plant Viruses Structure, genome replication, Lytic and lysogenic cycle of bacteriophages, protein synthesis and assembly of DNA containing bacteriophages - T4, lambda, Mu, ΦX174 and M13 phages - RNA containing bacteriophages - MS2 and Φ6 group. Plant viruses - CaMV and Gemini Virus - RNA containing plant viruses - TMV, Cowpea mosaic viruses, Bromo mosaic viruses and Satellite viruses.	9	Text Book1 Reference book 3
III	Animal Viruses Mechanism of viral entry, multiplication and release from host cell. Pathogenicity of DNA containing animal viruses - Adeno viruses, Herpes viruses, Pox viruses, RNA containing animal viruses - Rhabdo virus, Hepatitis viruses, Orthomyxo virus, H1N1, Paramyxovirus, HIV and Rubella virus. Emerging foodborne viruses a case study- Noro virus and Hepatitis a virus (HAV).	10	Text Book1 Reference Book 1
IV	Diagnostic Methods Immunodiagnosis - Staining and microscopy for viral inclusion bodies analysis by Electron microscopy, Haemagglutination, Complement fixation, Neutralization, Western blot, RIPA, Flowcytometry and Immunohistochemistry. Nucleic acid based diagnosis - Nucleic acid hybridization, Polymerase chain reaction, Microarray to detect protein and nucleotides.	10	Text Book1 Journals
V	Prophylaxis Viral Vaccines - Conventional vaccines and recombinant vaccines immunomodulators (cytokines). Antivirals - Interferon: Definition and its types, Mass production of Interferon, anti retrovirals - mechanism of action and drug resistance. Modern approaches of virus control - Anti-sense RNA, siRNA. Case Study: A 25-year-old female living in a tropical region presents with a sudden high fever, severe headache, retro-orbital pain, muscle and joint pain, and a rash. She mentions having been bitten by mosquitoes frequently in the past few	10	Text Book1 Reference book 1 & 2 E books Journals



	days. Laboratory tests confirm the presence of Dengue virus RNA in her blood. What preventive measures can be taken to reduce the risk of Dengue virus transmission? What is the treatment approach for a patient with Dengue fever?		
	Total	48	

Text book	1.	Dimmock N J, Easton A J, and Leppard K N, 2016, Introduction to Modern Virology, 7th Edition, Blackwell publishing, New Jersey..
	2.	Stainier R V, Ingraham J L, Wheelis M L and Painter P R, 1992, The General Microbiology, 5th Edition, Macmillan, Hampshire and London.
Reference Books	1.	Ananthanarayanan R and CK Jayaram Panicker, 2017, Introduction to Medical Microbiology, 10th Edition, The Orient Longman, New Delhi.
	2.	Black J G and Black LJ, 2017, Microbiology - Principles and Explorations, 10th Edition, John Wiley and Sons Inc. New York.
	3.	Rogger Hull, 2001, Mathews Plant Virology, 4th Edition, Academic Press, New Delhi.
	4.	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.)

Journal and Magazines	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.)
E-Resources and Website	<a)"="" href="https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.">https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/7%3A_Microbial_Genetics.)

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester - II CORE : MEDICAL BACTERIOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CD	MEDICAL BACTERIOLOGY	CORE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the indigenous microbial flora the principle of Gram positive and Gram negative organisms the importance of zoonotic diseases.
Prerequisite	Knowledge on basic characteristics of microorganisms

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the epidemiological concepts in identifying the etiology of disease outbreak.	K3
CO2	Analyze and identify the gram positive bacterial pathogens from clinical samples.	K4
CO3	Analyze and identify the gram negative bacterial pathogens from clinical samples	K4
CO4	Analyze and identify the other significant bacterial pathogens from clinical samples.	K4
CO5	Develop infection control policy, antimicrobial sensitivity and resistance pattern of pathogenic bacteria and waste disposal.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓
CO5	✓	✓	✓		✓



24MBP2CD	MEDICAL BACTERIOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Indigenous normal Microbial flora Indigenous normal microbial flora of human body. General attributes and virulence factors of bacteria causing infections. Epidemiology of infections. Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis.	10	Text Book 1 and Reference Book 2
II	Gram Positive organisms Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . Role of cell signaling and quorum sensing in microbial diseases	8	Text Book 2
III	Gram Negative organisms Gram negative organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of <i>E. coli</i> , <i>Klebsiella pneumoniae</i> , <i>Salmonella typhi</i> , <i>Shigella dysenteriae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio cholerae</i> , <i>Bordetella pertussis</i> , <i>Neisseria gonorrhoeae</i> , and <i>Neisseria meningitidis</i> , <i>Brucella abortus</i> .	10	Text Book 1
IV	Miscellaneous bacteria A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Actinomycetes (<i>Actinomyces</i> and <i>Nocardia</i>) and Spirochaetes (<i>Treponema</i> , <i>Borrelia</i> , <i>Leptospira</i>), <i>Brucellae</i> , <i>Listeria</i> , <i>Monocytogenes</i> , <i>Mycoplasma</i> , <i>Rickettsia</i> , <i>Chlamydiae</i> , <i>Campylobacter</i> and <i>Helicobacter pylori</i> .	10	Text Book 2 and Reference book 3,4
V	Zoonotic diseases Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions. Hospital waste disposal – Plastic, Gloves and Paper. Ethical committee – functions. Antimicrobial resistance and Multi drug resistance. Case Study: A 35-year-old man presented with abdominal pain and bloody diarrhea. He experienced fever, chills, nausea and vomiting. A stool culture was sent to the microbiology laboratory. Identify the organism and its importance in causing infection.	10	Text Book 2
Total		48	



Text book	1.	Ananthanarayan R and Paniker C. K. J, 2020, Textbook of Microbiology , 11th Edition, Universities press pvt. Ltd.
	2.	Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. 2013, Jawetz, Melnick and Adelberg's Medical Microbiology , 26 th edition. McGraw Hill Publication
Reference Books	1.	Goering R., Dockrell H., Zuckerman M. and Wakelin D, 2007, Mims' Medical Microbiology , 4 th Edition. Elsevier.
	2.	Willey JM, Sherwood LM, and Woolverton CJ, 2013, Prescott, Harley and Klein's Microbiology , 9 th Edition. McGraw Hill Higher Education
	3.	Madigan MT, Martinko JM, Dunlap PV and Clark DP, 2014, Brock Biology of Microorganisms , 14 th Edition. Pearson International Edition.
	4.	ARORA D.R. 2017, TEXTBOOK OF MICROBIOLOGY , 5th edition, CBS publisher.

Journal and Magazines	https://www.sciencedirect.com/journal/international-journal-of-medical-microbiology
E-Resources and Website	https://microbiologyinfo.com/category/bacteriology/

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – II CORE : RECOMBINANT DNA TECHNOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CE	RECOMBINANT DNA TECHNOLOGY	CORE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the utilization of different DNA manipulating enzymes and its exploitation for beneficial applications. the development of clones and transform them into organisms, making them to produce new products. how to utilize the microbial system in developing products of commercial importance.
Prerequisite	Knowledge on Genetic Recombination

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the ideas of restriction modification system, towards evolution of recombinant DNA technology	K3
CO2	Reframe different vectors in the development of new recombinants	K4
CO3	Employ transport vectors for producing recombinant cells	K4
CO4	Measure and screen the recombinants	K4
CO5	Synthesize commercially important products of microbial origin by rDNA techniques	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CE	RECOMBINANT DNA TECHNOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Enzymology of rDNA Technology History and Scope of rDNA technology - Restriction modification system. Enzymes involved in rDNA techniques, its classification, cofactor involved and mode of action - Restriction endonuclease, Restriction Exonuclease, Polymerases, Klenow, DNA dependent RNA polymerase, Ligase, Reverse Transcriptase, Terminal Transferase, polynucleotide kinase, alkaline phosphatase.	10	Text Book 1
II	Vectors Introduction to vectors and types - Host cells and vectors - Host cell types (prokaryotic and eukaryotic) - plasmid vectors (host range and incompatibility) pBR322, pUC18/19; Phage based vectors - M13 and Lambda; cosmids; phagemids; fosmid; Artificial chromosomes - BACs; Eukaryotic vectors - YAC; Shuttle vectors; plant vectors; (Ti plasmid based vectors and caulimoviral vector) - Expression vectors for prokaryotes and eukaryotes; Vectors with tags - Histidine tags.	10	Text Book 1
III	Cloning and Transformation Cloning strategies - DNA cloning a) Sticky ends b) Blunt ends c) Homopolymeric tailing d) Use of adapters and linkers; Construction of genomic DNA libraries (shotgun cloning) and cDNA libraries; Gene transfer techniques in plants, animals and microbes - Transformation, electroporation, microprojectile system, liposome mediated transfer, gene gun etc.,	10	Text Book 1
IV	Screening and characterization of cloned DNA Screening: Direct: Antibiotic resistance, lacZ complementation (Blue-white selection), plaque phenotype; Indirect: Immunochemical detection - Nucleic acid hybridization, Blotting - Dot and Colony Blotting; Chromosome walking. Chromosome jumping. Characterization of clones - Restriction mapping - restriction fragment length polymorphism (RFLP) - Polymerase chain reaction (PCR) - Types of PCR and their applications. DNA sequencing: Primer walking, Maxim and Gilbert method, dideoxy method and micro array.	9	Text Book 2 and Reference Book 1
V	Applications Gene silencing techniques: Introduction to siRNA and siRNA technology, micro RNA, construction of siRNA vectors, principle and application of gene silencing. CRISPR, CRISPR/Cas9 technology. Gene knockouts and Gene Therapy: Creation of knockout mice, suicide gene therapy,	9	Text Book 2 and Reference Book 2



gene replacement, gene targeting. Other applications: Transgenic, Genome projects and their implications, application in global gene expression analysis. Applications of recombinant DNA technology in medicine, agriculture, veterinary sciences and protein engineering.		
Case Study: In 2020 there was a viral pandemic disease that shook the entire world. Design a recombinant product that could have tackled the virus by developing immunity in individuals, in the form of an active or passive vaccine.		
Total	48	

Text book	1.	Brown, T.A. 2020, Gene Cloning and DNA Analysis: An Introduction, Wiley- Blackwell. 8th Edition. New Jersey. United States.
	2.	Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten. 2010, Molecular Biotechnology. Principles and Applications of Recombinant DNA, 4th Edition. ASM Press. University of Michigan. United States.
Reference Books	1.	Krebs, J.E., Goldstein E.S. and Kilpatrick S.T. 2018, Lewin's Gene XII, Jones & Bartlett Publishers, Boston. United States.
	2.	Primrose, S.B. and Twyman, R.M. 2016, Principles of Gene manipulation and Genomics, 8th Edition, John Wiley and Sons Ltd, Wiley-Blackwell. United Kingdom.
	3.	Thieman, W.J. and Palladino, M.A. 2019, Introduction to Biotechnology, 4th Edition, Pearson Education, Noida.
	4.	Susan, R.B. 2008, Biotechnology, Cengage Learning Pvt. Ltd., New Delhi.

Journal and Magazines	Advances in Biotechnology & Microbiology
E-Resources and Website	https://archive.nptel.ac.in/courses/102/103/102103013/#downloads

Learning Method	Chalk and Talk/ Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester - II							
CORE PRACTICAL: IMMUNOLOGY AND MOLECULAR TECHNIQUES							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2CP	CORE PRACTICAL: IMMUNOLOGY AND MOLECULAR TECHNIQUES	CORE		-	72	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> the basic principles and procedures of diagnostic methods the different types of gene transfer mechanism the extraction of chicken antibodies from egg yolk.
Prerequisite	Knowledge on basic microbiological techniques

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Analysis of clinical samples for identification of pathogens	K4
CO2	Execute gene transfer techniques	K4
CO3	Able to isolate microbial genetic material	K4
CO4	Estimate the antigen and antibody concentration	K4
CO5	Appraise the process of virus cultivation from egg	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓



24MBP2CP	CORE PRACTICAL : IMMUNOLOGY AND MOLECULAR TECHNIQUES	SEMESTER II
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Serological test for HBsAg and HBcAg
2	Antigen, Antibody detection by Dot ELISA
3	Immunodiffusion – Ouchterlony method.
4	Isolation and Identification of bacteria from clinical samples - Urine, Pus, Sputum, Stool
5	Determination of Minimal Inhibitory Concentration – Broth dilution method
6	Isolation and separation of chromosomal DNA from bacteria
7	Bacterial Transformation and Conjugation
8	Restriction Digestion of chromosomal DNA
9	Detection of Protein by Western Blotting
10	Isolation and titration of coli phages from sewage sample
11	Cultivation of animal virus by Egg inoculation – Yolk sac, Amniotic cavity Demonstration
12	Production of Chick Antibodies (IgY) – Demonstration



References

- 1 James. C. Cappuccino. 2017, Microbiology A laboratory manual, 11th edition, Pearson education publishers.
- 2 Aneja. K.R. 2012, Experiments in Microbiology, plant pathology and biotechnology, 4th Edition. New age publishers.
- 3 Rajan S. Selvi Christy. R, 2019, Experimental Procedures in Lifesciences, CBS Publishers & Distributors Pvt Ltd
- 4 Kannan, N, 1997, Laboratory Manual of General Microbiology, 1st Edition, Panima Publishing house



Semester - II CORE : BIONANOTECHNOLOGY							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24MBP2DA	BIONANOTECHNOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • the role of microbes and other eukaryotes in the synthesis of nanoparticles • advanced methods of characterization of nano particles • educate the potential applications of nano particles/ materials in a variety of areas.
Prerequisite	Knowledge on Biological science

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explore the basics of Nanosciences and its applications	K3
CO2	Synthesize nanoparticles at the laboratory scale.	K4
CO3	Analyze the nanoparticles by spectral and electron microscopic techniques	K4
CO4	Apply bionanomaterials in drug development and delivery.	K4
CO5	Criticize the merits and demerits of nanomaterial applications.	K4

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	
CO4	✓		✓	✓	✓
CO5		✓	✓	✓	✓



24MBP2DA	BIONANOTECHNOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction to bionanotechnology History – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanobiomaterials, biocompatibility, nanomedicine, nano tube, nanowires, quantum dots, nanocomposite, nanoparticles, nanosensors, nanofiber, Dendrimeter. Emergence of Bionanotechnology.	10	Text Book 1 Reference book 1
II	Synthesis of nanoparticles Synthesis - Top-down approach and bottom-up approach - Types of nanoparticles production - principle and mechanism of synthesis – physical - Sonicator, Ball mill, ablation, evaporation-condensation; chemical - reducing method - chemical reduction, irradiation, electrochemical, photoreduction; biological - microbes, plants. Green synthesis	10	Text Book 2 Reference book 1
III	Characterization of Nanoparticles Physical and chemical properties of nanoparticles. Characterization- UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology: X- Ray crystallography, FTIR, NMR.	10	Text Book 1 Reference book 3
IV	Applications of bionanotechnology Targeted drug delivery, biosensors and biomarkers, food and agriculture, DNA nanotech, nanoviricides, tissue engineering, gene delivery. Antibacterial activities of nanoparticles. Toxicology in nanoparticles – Dosimetry. Molecular nanotechnology – nanomachines – collagen.	9	Text Book 2 Reference book 2
V	Merits and demerits of nanoparticles Health and safety implications from nanoparticles: Health issues – Environmental issues – Need for regulation – Societal implications – Possible military applications – Potential benefits and risks for developing countries – Intellectual property issues. Bioinformatic tools in nanotechnology: molecular modeling, docking and computer assisted molecular design. Case study- Merits and demerits of any two nanoparticles in health and environment safety	9	Text Book 2 Reference book 4
	Total	48	



Text books	1.	Parthasarathy BK. 2007, Introduction to Nanotechnology, Isha Publication.
	2.	Elisabeth Papazoglou and Aravind Parthasarathy. 2007, Bionanotechnology, Morgan and Claypool Publishers, New Delhi.
Reference Books	1.	Bernd Rehm, 2006, Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press.
	2.	David E Reisner and Joseph D Bronzino, 2008, Bionanotechnology: Global Prospects. CRC Press, New Delhi.
	3.	Ehud Gazit, 2006, Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press.
	4.	Kamali Kannangara, 2005, Nanotechnology: Basic science and Emerging technologies- Mick Wilson, Overseas Press.

Journal and Magazines	https://jnanobiotechnology.biomedcentral.com https://nano-magazine.com
E-Resources and Website	https://archive.nptel.ac.in/courses/118/107/118107015 https://www.coursera.org/learn/nanotechnology

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations



SEMESTER II
DSE: BIOCHEMISTRY OF TOXICOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24BCP2DA	BIOCHEMISTRY OF TOXICOLOGY	DSE	36	12	-	3

Preamble	<p>This course has been designed for students to learn and understand</p> <p>The biochemical basis of toxicology</p> <p>The effects and metabolism of toxins</p> <p>General toxicology, methods of toxicity testing, toxins from microbes, carcinogenic & teratogenic toxins, pesticide, metal and chemical toxicology</p>
Prerequisite	Basic knowledge about Toxicity

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Explain the importance of toxicology	K2
CO2	Distinguish and evaluate the biochemical effects of toxic agents on cellular macromolecules and tissues	K4
CO3	Compare the different genetic methods used for testing toxicity	K4
CO4	Analyze the effects and metabolism of various microbial toxins, teratogens and carcinogens	K4
CO5	Assess the mode of action of toxic pesticides, heavy metals, chemicals and air pollutants	K5

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓



24BCP2DA	BIOCHEMISTRY OF TOXICOLOGY
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Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction to Toxicology Definition and scope of toxicology, Classification of toxic agents. Dose-response relationship: Synergism and Antagonism, Determination of ED50 and LD50. Acute and chronic exposures, Factors influencing toxicity - Abiotic and Biotic factors, Chemical interactions - Bioaccumulation and Bio-magnification	9	Text Book, Reference book and E-Resources
II	Biochemical basis of Toxicology Toxicokinetics-ADME (Absorption, Distribution, Metabolism and Excretion) and Toxicodynamics. Mechanisms of Toxicity, Interaction of toxicant with target molecules - Disturbance of excitable membrane function. Altered calcium homeostasis. Blood brain barrier penetration. Organ Toxicology, Genetic and reproductive toxicology, Toxicogenomics.	9	Text Book and Reference Book
III	Principles and procedures of testing for acute toxic effects Toxicity testing - In-vitro test systems - Bacterial mutation tests: Fluctuation tests, Ames test, Eukaryotic mutation test: Micronucleus Test, Comet Assay, Chromosomal Aberration Test. In-vivo mammalian mutation tests - Host mediated assay and Dominant lethal test. Use of drosophila in toxicity testing. Toxicity testing in animals. Toxicological evaluation of Recombinant DNA-derived proteins.	10	Text book, Reference book, E-Resources and YouTube Videos
IV	Effects and Metabolism of toxins Fungal toxins, Mycotoxins - Aflatoxins, Bacterial toxins - Exotoxins and Endotoxins, Viral toxins, Algal toxins, Teratogens, Carcinogens, Mutagens, Snake venom toxin, Spider, Scorpion and Jellyfish toxins, Antivenom. Xenobiotic metabolism: Phase I- III reactions, Cytochrome-P450. Free radical theory of oxygen toxicity.	10	Text book, NPTEL, and E-resources
V	Pesticide toxicology, Metal toxicology, Chemical toxicology, Air and water pollutants Mechanism and site of action of Chlorinated organics (DDT, BHC), organophosphates and carbamates. Fungicides, Herbicides. Environmental consequences of pesticide toxicity. Biopesticides, Mode of action of toxic heavy metals - arsenic, mercury, cadmium and lead. Biochemical effects of	10	Text book, NPTEL and Reference book



	ozone, peroxyacetyl nitrate (PAN), carbon monoxide, nitrogen oxides, sulphur dioxide and cyanide. Drug induced toxicity-example- Paracetamol. Common air pollutants, water pollutants and their sources, air pollution due to methyl-isocyanate (MIC) and asbestos. Toxicology of food additives, Case studies.		
	Total	48	

Text Book	1.	<i>Klaassen Curtis, D., 2019, "Casarett and Doull's Toxicology - The basic Science of Poisons", 9th edition, McGraw Hill Education, London.</i>
	2.	<i>Cockerham, L.G. and Shane, B.S., 2019, "Basic Environmental Toxicology", 1st edition, CRC Press, New York</i>
Reference Books	1.	<i>Robert, S.M. and James, R.C., 2015, "Principles of Toxicology: Environmental and Industrial Applications", 3rd Edition, John Wiley and Sons, New York.</i>
	2.	<i>De, A.K., 2017, "Environmental Chemistry", 8th Edition, Newage International Publishers, New Delhi..</i>
	3.	<i>Gupta, P.K., 2016, "Fundamentals of Toxicology - Essential concepts and Applications", 1st edition, Academic Press, Cambridge, USA.</i>
	4.	<i>Gupta, R., 2019, "Biomarkers in Toxicology", 2nd Edition, Academic Press, Cambridge, USA.</i>

Journal and Magazines	https://www.sciencedirect.com/science/article/abs/pii/S014181302100354 https://www.europeanreview.org/wp/wp-content/uploads/1633-1653.pdf https://pmc.ncbi.nlm.nih.gov/articles/PMC10247286/ https://www.tandfonline.com/doi/full/10.1080/17435390.2020.1815886
E-Resources and Website	https://onlinecourses.swayam2.ac.in/ini24_bt04/ [NPTEL] https://byjus.com/biology/difference-between-biomagnification-and-bioaccumulation/

Learning Methods	Chalk and Talk/ Video tutorials/PPT/ GD/ Assignment/ Seminar
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Focus of the Course	Skill Development/Employability/Entrepreneurial development/Innovations
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Semester – II DSE: FORENSIC BIOTECHNOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24BTP2DA	FORENSIC BIOTECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none">Basics and fundamentals of the sample collection and examination in forensic aspectsDifferent types of DNA profiling and DNA databases used in Forensic analysisApplications of Forensic Biotechnology in various fields	
Prerequisite	Knowledge on techniques and applications of forensic Biotechnology	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Infer the sample collection for forensic examinations	K3
CO2	Know the methods to characterize the different samples on forensic prospective	K3
CO3	Interpret and examine forensic evidence by DNA profiling methods	K3
CO4	Analyze and interpret the forensic DNA Statistics and Database	K4
CO5	Conclude the significance and applications of Forensic Biotechnology	K5

Mapping with Program Outcomes					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓



24BTP2DA	FORENSIC BIOTECHNOLOGY
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Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Forensic science - History, scope, branches and functions. Forensic science in international perspectives- INTERPOL and FBI. Duties of forensic scientists. Forensic laboratories in India and worldwide. Collection and Preservation of biological samples-Blood, Semen, Saliva, Vomit, Hair, Fibers, Urine and Fecal matter from crime scene.	08	https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000016FS/P000699/ M011531/ET/1516257285FSC_P12_M5_e-text.pdf
II	Importance of Hair, Sperm and Blood in forensic characterization. Hair- morphology, tests for their identification. Blood- composition and properties, presumptive and confirmatory tests. Sperm-composition, morphology of spermatozoa, presumptive and confirmatory tests (including Azoospermic semen stains), seminal fluid isozymes typing.	10	1516257136FSC_P12_M2_e-text.pdf
III	Structure of DNA, DNA extraction-organic and inorganic extraction. Variations in DNA related to forensic Biotechnology, DNA profiling-history and applications. Methods used in DNA profiling-Restriction Fragment Length Polymorphism (RFLP), Polymerase Chain Reaction (PCR), RAPD, Short Tandem Repeat (STR) Analysis, Single Nucleotide Polymorphism (SNP) Analysis, Mitochondrial DNA (mtDNA) Profiling, Y-Chromosome STR (Y-STR) Analysis and Variable Number Tandem Repeats (VNTR) Analysis.	10	https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2021.646130/full
IV	DNA Statistics- allele frequency, Random Match Probability (RMP), Paternity/Maternity index, Sibling index. Impact of Human genome project on Forensic Biotechnology. DNA forensic databases; Ethical, legal, and social issues associated with DNA data banking, potential benefits of DNA data banking, quality control, certification and accreditation.	10	https://wbja.nic.in/wbja_adm/files/dna%20profilin g%20%20cfl.pdf
V	Forensic Biotechnology Applications –Criminal investigations, Disputed paternity cases, Child swapping, Disaster Victim Identification (DVI), Civil immigration, Veterinary, Wildlife,	10	https://www.walshmedic almedia.com/open-access/application-of-dna-fingerprinting-in-an-



	Environment, Public Health and Epidemiology, Agriculture and Food safety. New and Future technologies for Forensic Biotechnology.		alleged-case-of-paternity-2161-1009-1000165.pdf
	Total	48	


Text Book	1.	Richard Saferstein E, 2020, "Forensic Science Handbook", 2 nd Edition, Prentice Hall, New Delhi.
Reference Books	1.	William Tilstone J, Kathleen Savage A and Leigh Clark A, 2006, "Forensic Science: An Encyclopedia of History, Methods and Techniques", 1 st Edition, ABC – CLINO Inc, California.
	2.	Allan Jamieson and Scott Bader, 2016, "A Guide to Forensic DNA Profiling", 10 th Edition, John Wiley & Sons, UK.
	3.	John Butler M, 2005, "Forensic DNA Typing - Biology, Technology, and Genetics of STR Markers", 2 nd Edition, Academic Press, United States.
	4.	John Butler M, 2009, "Fundamentals of Forensic DNA Typing", 1 st Edition, Academic Press, United States.

Journal and Magazines	Singh, Harendra Nath. (2021). Collection, Preservation and Transportation of Biological Evidence Forensic DNA Analysis. 9. 1123-1130.
E-Resources and Website	https://pmc.ncbi.nlm.nih.gov/articles/PMC3168143/ https://www.sciepublish.com/article/pii/279 https://blog.bccresearch.com/technology-trends-shaping-the-future-of-forensics-industry

Learning Methods	Learning Management System, PPT, Flipped Classroom
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Focus of the Course	Skill Development/Employability/Entrepreneurial Development
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[Signature]
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APPROVED		
BoS- 18th 08/11/2024	AC - 18th 26/11/2024	GB -



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M.Sc. Microbiology (Students admitted during the AY 2024-25)